

CLAIMS

1. An ignition device for internal combustion engine comprising:

- a main chamber (1) intended for containing a main combustible mixture and fitted with a compression system of said mixture; and
- 5 - an igniter (11) comprising a precombustion chamber (2) intended for containing a combustible mixture and an ignition system (13, 14) of the combustible mixture contained in the precombustion chamber (2), the precombustion chamber being defined by a precombustion chamber body (12) having a head (12a) including passageways (15a – 15i), the head (12a)  
10 of the pre-heating body (12) separating the precombustion chamber (2) from the main chamber (1) and communicating the precombustion chamber (2) and the main chamber (1) through the passageways (15a – 15i), characterised in that the passageways comprise at least one passageway (15a) enabling the propagation of a flame front from the precombustion  
15 chamber (2) to the main chamber (1) when the engine operates on low load and at least one passageway not enabling the propagation of a front flame from the precombustion chamber (2) to the main chamber (1) while enabling the passageway of the precombustion chamber (2) to the main chamber (1) of unstable compounds derived from the combustion of the combustible  
20 mixture in the precombustion chamber (2).

2. A device according to claim 1, characterised in that the number of passageways enabling the propagation of a flame front provided in the head (12a) of the precombustion chamber body (12) is 1 to 5, preferably 1.

3. A device according to claim 1 or 2, characterised in that the number of  
25 passageways not enabling the propagation of a flame front is 1 to 20, preferably 3 to 15.

4. A device according to any of the previous claims, characterised in that the passageway(s) enabling the propagation of a flame front have a diameter greater than 1 mm up to 3 mm, preferably up to 1.5 mm.

30 5. A device according to any of the previous claims, characterised in that the passageways not enabling the propagation of a flame front have a diameter  $\leq 1$  mm, preferably 0.5 to 1 mm

6. A device according to any of the previous claims, characterised in that  
35 the head (12a) of the precombustion chamber body (12) has the shape of a spherical cap.

7. A device according to claim 6, characterised in that the passageways (15a – 15i) are oriented following radii of the spherical cap.

8. A device according to any of the previous claims, characterised in that the precombustion chamber body (12) is a metal alloy having a thermal conductivity at 20°C of at least 10 W/K/m, preferably at least 30 W/K/m.

9. A device according to claim 8, characterised in that the alloy is a copper alloy.

10. A device according to claim 9, characterised in that the alloy is the alloy Cu Cr 1 Zr.

11. A device according to any of the claims 1 to 7, characterised in that the internal wall of the precombustion chamber body (12) and/or the external wall of the head (12a) of the precombustion chamber body (12) and/or the walls of the passageways (15a – 15i) are coated with a refractory coating layer.

12. A device according to claim 11, characterised in that the refractory coating layer is selected among:  $\text{Al}_2\text{O}_3$ , ZrY and  $\text{TiB}_2$ .

13. A device according to claim 11 or 12, characterised in that the refractory coating layer has a thickness of 0.5 to 100  $\mu\text{m}$ , preferably 1 to 50  $\mu\text{m}$ .

14. A method for igniting an internal combustion engine wherein:

- a main combustible mixture is introduced into a main chamber and a combustible mixture in a precombustion chamber communicating with the main chamber through at least one passageway enabling the propagation of a flame front and at least one passageway not enabling the propagation of a flame front ;
- the combustible mixture contained in the precombustion chamber is burnt; and
- c) for low load operation of the engine:
  - at least one flame front is let through from the precombustion chamber to the main chamber via the passageway enabling the propagation of a flame front and the main combustible mixture is ignited via the flame front ;
- d) for high load operation of the engine ;
  - unstable compounds from the combustion of the combustible mixture from the precombustion chamber while preventing any propagation of a flame front, are passed from the precombustion chamber to the main chamber, via the passageways, and the main combustible mixture

seeded with the unstable compounds undergoes mass self-ignition in the main chamber.

5 15. An igniter for combustion engine comprising a precombustion chamber defined by a precombustion chamber body having a head fitted with passageways, the precombustion chamber being intended for containing a combustible mixture, and an ignition system of the combustible mixture contained in the precombustion chamber, characterised in that the precombustion chamber head comprises at least one passageway having a diameter greater than 1 mm up to 3 mm, preferably up to 1.5 mm, and at least  
10 one passageway having a diameter equal to or smaller than 1 mm, preferably 0.5 to 1 mm.

16. An igniter according to claim 15, characterised in that the precombustion chamber head comprises 1 to 5 passageways of diameter greater than 1 mm, preferably 1.

15 17. An igniter according to claim 15 or 16, characterised in that the precombustion chamber head comprises 1 to 20 passageways of diameter smaller than or equal to 1 mm, preferably 3 to 15.

18. An igniter according to any of the claims 15 to 17, characterised in that the precombustion chamber head is a spherical cap.

20 19. An igniter according to claim 18, characterised in that the passageways are oriented following radii of the spherical cap.